MECH 5001 - Seminar: Introduction to Research (1 Credit)
This course is intended to introduce graduate students to the fundamental skills and methods needed to perform research. Topics include writing technical papers, presentation skills, testing methodology, hypothesis creation and more. Max Hours: 1 Credit.
Grading Basis: Letter Grade
Restriction: Restricted to graduate students

MECH 5020 - Biomechanics (3 Credits)
Static and dynamic biomechanical analysis, effects of mechanical loading on bone and cartilage, design considerations in orthopaedic devices, muscle function, biomechanics of human movement, cardiovascular biomechanics. Graduate standing or permission of the instructor required. Cross-listed with MECH 4020. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Restriction: Restricted to graduate students
Typically Offered: Summer.

MECH 5024 - Mechanical Behavior of Materials (3 Credits)
Students will learn about the mechanical behavior of materials using a multi-scale, materials oriented approach. The course will relate how atomistic and molecular mechanisms relate to macroscopic and continuum properties of materials across acute and long-term time scales. Graduate standing or permission of the instructor required. Cross-listed with MECH 4024. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Restriction: Restricted to graduate students
Typically Offered: Fall.

MECH 5025 - Advanced Biomechanics (3 Credits)
This course provides training in computational and experimental methods for biomechanical engineering analysis. Topics include finite element analysis of biological systems, orthopedic device design, medical imaging analysis, mechanical characterization of biological tissues, and biomechanics of human movement. Prereq: MECH 4020 or MECH 5020. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Prereq: MECH 4020 or MECH 5020

MECH 5110 - Numerical Methods for Engineers (3 Credits)
Introduces numerical analysis. Solution of linear and nonlinear equation systems. Numerical methods for ordinary and partial differential equations. Engineering applications. Prereq: Graduate standing or permission of instructor required. Cross-listed with MECH 4110. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Restriction: Restricted to graduate students

MECH 5112 - Introduction to Internal Combustion Engines (3 Credits)
This course provides an introduction to the major characteristics of internal combustion engines and defines the major parameters used to describe the engine operation and design conditions. Students perform analysis of the thermal performance of the engines. Graduate standing or permission of the instructor required. Cross-listed with MECH 4112. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Restriction: Restricted to graduate students
MECH 5124 - Yield-Limited Behavior of Materials (3 Credits)
Analysis of material behavior within the "elastic range," with emphasis on the phenomenon of yield and factors that influence it. Examination of the theory of dislocations; study of strengthening mechanisms in solids. Consideration of various time-dependent but reversible (inelastic) deformation phenomena. Presentation of appropriate engineering case studies to augment various topics. Graduate standing or permission of the instructor required. Prereq: MECH 5143 with a grade of B- or higher. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Prereq: MECH 5143 with a grade of B- or higher Restriction: Restricted to graduate standing or higher

MECH 5133 - Theory of Inelastic Materials (3 Credits)
Mathematical theory of linear viscoelasticity. Finite elements models. Solution of boundary-value problems in linear viscoelasticity. Non-Newtonian flow. Selected topics in nonlinear material behavior. Graduate standing or permission of the instructor required. Prereq: MECH 5143 with a B- or higher. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Prereq: MECH 5143 with a grade of B- or higher Restriction: Restricted to graduate standing or higher

MECH 5141 - Viscous Flow (3 Credits)
Viscous incompressible fluid flows. Topics include derivation of equations governing viscous compressible fluid motion; specializations to simple flows; boundary-layer theory; similarity solutions; introduction to turbulence and Reynolds stresses. Prereq: Graduate standing or permission of instructor required. Cross-listed with MECH 4141. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Prereq: MECH 5143 with a grade of B- or higher Restriction: Restricted to graduate standing or higher

MECH 5142 - Statistical Thermodynamics (3 Credits)
Introduces the molecular interpretation and calculation of thermodynamic properties of matter, thermodynamic probability, distribution functions, Schrodinger wave equations and solutions and ensemble theory. Applications to ideal and real gases, solids, liquids, radiation, conduction electrons, and chemical equilibrium. Graduate standing or permission of instructor required. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Restriction: Restricted to graduate students

MECH 5143 - Theory of Elasticity (3 Credits)
Review of the basic equations of linear theory of elasticity. St. Venant torsion and flexure. Plane strain, plane stress, and generalized plane stress. Application of conformal mapping and Fourier transform techniques. Graduate standing or permission of instructor required. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Restriction: Restricted to graduate students

MECH 5144 - Plasticity and Creep (3 Credits)
Inelastic deformation of materials such as metals, alloys, glasses, composites and polymers from the phenomenological and structural point of view. Case studies of plastic and creep deformations in engineering materials. Prereq: MECH 5143 with a grade of B- or higher and graduate standing or permission of the instructor required. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Prereq: MECH 5143 with a grade of B- or higher Restriction: Restricted to graduate standing or higher

MECH 5161 - Compressible Flow (3 Credits)
Energy, continuity, and momentum principles applied to compressible flow; one-, two-, and three-dimensional subsonic, supersonic and hypersonic flows. Normal and oblique shocks, and method of characteristics. Prereq: MECH 5141 with a grade of B- or higher and graduate standing or permission of the instructor required. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Prereq: MECH 5141 with a B- or higher Restriction: Restricted to graduate standing or higher

MECH 5162 - Heat Transfer I (3 Credits)
Review of equations governing transport of heat by conduction and radiation. Analytical and numerical solution of boundary value problems representative of heat conduction in solids. Radiation properties of solids, liquids and gases; transport of heat by radiation. Prereq: Graduate standing or permission of instructor required. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Restriction: Restricted to graduate students

MECH 5163 - Dynamics (3 Credits)
Review of Newtonian dynamics, Lagrange's equation for particles, systems and rigid bodies. Conservative and non-conservative systems, moments of inertia, principal axes, angular momentum and Euler equations. Illustrations from spinning bodies, including tops, gyrocompass and rotating machinery. Prereq: Graduate standing or permission of instructor required. Cross-listed with MECH 4163. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Restriction: Restricted to graduate students

MECH 5166 - Computerized Numerical Control (CNC) Manufacturing (3 Credits)
Modern manufacturing engineering concepts using computerized numerical control (CNC). The students learn state-of-the-art CNC methodologies, including digitizing, drawing, generating codes, and manufacturing using modern CNC machines. Prereq: Graduate standing or permission of instructor required. Cross-listed with MECH 4166. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Restriction: Restricted to graduate students

MECH 5172 - Heat Transfer II (3 Credits)
Review of equations governing transport of heat in fluids in motion. Description of heat transfer in free and forced convection, including laminar and turbulent flow. Dimensional analysis and heat transfer correlations, numerical methods and combined heat transfer mechanisms. Graduate standing or permission of the instructor required. Prereq: MECH 5141 with a B- or higher. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Prereq: MECH 5141 with a B- or higher Restriction: Restricted to graduate standing or higher

MECH 5175 - Finite Element Stress Analysis (3 Credits)
Students learn basic theory of finite element analysis (FEA) as it applies to stress analysis and design of mechanical components. Commercial package will be used giving students practical experience in the use of FEA. Graduate standing or permission of the instructor required. Prereq: MECH 5143 with a B- or higher. Cross-listed with MECH 4175. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Prereq: MECH 5143 with a grade of B- or higher Restriction: Restricted to graduate standing or higher
MECH 5176 - Introduction to Sports Engineering (3 Credits)
Sports Engineering requires working both with the principles of biomechanics and the principles of engineering design and analysis. Using biomechanics is necessary in understanding the forces on the interface between the human athlete and his/her equipment. Prereq: Graduate standing or permission of the instructor required. Cross-listed with MECH 4176. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Restriction: Restricted to graduate students

MECH 5177 - Energy Conversion (3 Credits)
This introductory Energy Conversion course introduces the basic background, terminology, and fundamentals of various forms of energy conversion. The topics covered will include: fuel cells, batteries, photovoltaic systems, solar thermal, and wind energy. Prereq: Graduate standing or permission of instructor required. Cross-listed with MECH 4177. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Restriction: Restricted to graduate students

MECH 5178 - Solar Engineering (3 Credits)
This course provides the student with the basic ideas and calculation procedures on how solar processes work and how their performance can be predicted. Prereq: Graduate standing or permission of instructor required. Cross-listed with MECH 4178. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Restriction: Restricted to graduate students

MECH 5179 - Introduction to Turbomachinery (3 Credits)
This introductory Turbomachinery course introduces the basic background, terminology, and fundamentals of various forms of turbomachines. The analysis of the various turbomachines will be focused on the performance of the turbomachine. Prereq: Graduate standing or permission of instructor required. Cross-listed with MECH 4179. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Restriction: Restricted to graduate students

MECH 5180 - Advanced Heat Transfer (3 Credits)
This course provides fundamental concepts and applicable mathematical techniques for understanding the physics of various modes of heat transfer. Topics include heat conduction in finite and semi-infinite domains, phase change, microscale heat conduction, laminar forced and free convection, turbulence forced and free convection, and thermal radiation. Prereq: Graduate standing or permission of instructor required. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Restriction: Restricted to graduate students

MECH 5182 - Microscale Transport Phenomena (3 Credits)
This course provides the foundations on the physics of microscale transport phenomena, where continuum effects break down, with applications in MEMS and NEMS. Topics include gas microflows, liquid microflows, surface tension-driven flows, electrokinetics transport, kinetic theory, simulation techniques, lattice Boltzmann methods. Restriction: Restricted to graduate students in the College of Engineering, Design and Computing. Max hours: 3 Credits.
Grading Basis: Letter Grade
Restriction: Restricted to graduate standing majors in the College of Engineering, Design and Computing

MECH 5208 - Special Topics (1-3 Credits)
Subject matter to be selected from topics of current technological interest. Credit to be arranged. Prereq: Graduate standing or permission of instructor required. Cross-listed with MECH 4208. Repeatable. Max Hours: 9 Credits.
Grading Basis: Letter Grade
Repeatable. Max Credits: 9.
Restriction: Restricted to graduate students

MECH 5228 - Special Topics (1-3 Credits)
Prereq: MECH 3032 (Electric Systems-Circuits Lab). Repeatable. Max Hours: 9 Credits.
Grading Basis: Letter Grade
Repeatable. Max Credits: 9.
Prereq: MECH 3032.

MECH 5238 - Special Topics (1-3 Credits)
Graduate standing or permission of the instructor required. Repeatable. Max Hours: 9 Credits.
Grading Basis: Letter Grade
Repeatable. Max Credits: 9.
Restriction: Restricted to graduate students

MECH 5840 - Independent Study (1-3 Credits)
Available only through approval of the graduate advisor. Subjects arranged to fit needs of the particular student. Graduate standing or permission of the instructor required. Repeatable. Max Hours: 6 Credits.
Grading Basis: Letter Grade
Restriction: Restricted to graduate students

MECH 5939 - Internship (3 Credits)
Students gain engineering design experience involving application of specific technical concepts and skills in a supervised industrial environment. (Must have approval from MECH faculty.) Max Hours: 3 Credits.
Grading Basis: Letter Grade

MECH 5950 - Master's Thesis (1-6 Credits)
Graduate standing or permission of the instructor required. Repeatable. Max hours: 8 Credits.
Grading Basis: Letter Grade with IP
Repeatable. Max Credits: 8.
Restriction: Restricted to graduate students
Additional Information: Report as Full Time.

MECH 5960 - Master's Report (3 Credits)
Master of Science in Engineering report. Students seeking the Master of Science in Engineering, and who do not choose to do a thesis, must complete an individual project of an investigative and creative nature under the supervision of a member of the graduate faculty. Graduate standing or permission of the instructor required. Repeatable. Max hours: 6 Credits.
Grading Basis: Letter Grade with IP
Restriction: Restricted to graduate students
Additional Information: Report as Full Time.

MECH 5970 - Graduate Problem Course (3 Credits)
The graduate problem course is for the solution of specific problems in MECH specialty areas. Each student is assigned a set of problems of some difficulty requiring the use of the literature of the various areas covered. Prereq: 15 hours of graduate level courses in MECH. Max Hours: 3 Credits.
Grading Basis: Letter Grade
MECH 6184 - Advanced Fluid Mechanics (3 Credits)
This course provides a description of the advanced concepts for understanding the physics of fluid motion under different regimes. Topics include kinematics, stresses, equation of motion, vorticity transport, low Reynolds number flow, irrotational flow, interfacial flow, acoustics & waves, hydrodynamic stability & transition, turbulent flow. Prereq: MECH 5141.
Restriction: Restricted to students with graduate standing, or permission of instructor. Max Hours: 3 Credits.
Grading Basis: Letter Grade
Prereq: MECH 5141. Restriction: Restricted to students with graduate standing.

MECH 8990 - Doctoral Dissertation (1-10 Credits)
Graduate standing or permission of the instructor required. Repeatable.
Max hours: 10 Credits.
Grading Basis: Letter Grade with IP
Repeatable. Max Credits: 10.
Restriction: Restricted to graduate students
Additional Information: Report as Full Time.
Typically Offered: Fall, Spring.